INDIANA DEPARTMENT of EDUCATION

2023 INDIANA ACADEMIC STANDARDS

COMPUTER SCIENCE

KINDERGARTEN - GRADE 8

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Indiana Academic Standards Context and Purpose

Introduction

The Indiana Academic Standards for Grades K-8 Computer Science are the result of a process designed to identify, evaluate, synthesize, and create high-quality, rigorous learning expectations for Indiana students.

Pursuant to Indiana Code (IC) 20-31-3-1(c-d), the Indiana Department of Education (IDOE) facilitated the prioritization of the Indiana Academic Standards. The standards are designed to ensure that all Indiana students, upon graduation, are prepared with essential knowledge and skills needed to access employment, enrollment, or enlistment leading to service.

All standards are required to be taught. Standards identified as essential for mastery by the end of each grade band are indicated with shading and an “E.” The learning outcome statement for each domain immediately precedes each set of standards.

What are the Indiana Academic Standards and how should they be used?

The Indiana Academic Standards are designed to help educators, parents, students, and community members understand the necessary content for each grade level, and within each content area domain, to access employment, enrollment, or enlistment leading to service. These standards should form the basis for strong core instruction for all students at each grade level and content area. The standards identify the minimum academic content or skills that Indiana students need in order to be prepared for success after graduation, but they are not an exhaustive list.

While the Indiana Academic Standards establish key expectations for grade level knowledge and skills and should be used as the basis for curriculum, the standards by themselves do not constitute a curriculum. It is the responsibility of the local school corporation to select and formally adopt curricular tools, including textbooks and any other supplementary materials, that align with Indiana Academic Standards. Additionally, corporation and school leaders should consider the appropriate instructional sequence of the standards as well as the length of time needed to teach each standard. Every standard has a unique place in the continuum of learning, but each standard will not require the same amount of time and attention. A deep understanding of the vertical articulation of the standards will enable educators to make the best instructional decisions. These standards must also be complemented by robust, evidence-based instructional practices to support overall student development. By utilizing strategic, intentional instructional practices, other areas such as STEM and employability skills can be integrated with the content standards.

Indiana Academic Standards for Grades K-8 Computer Science

The Indiana Academic Standards for Grades K-8 Computer Science, based on the *K-12 Computer Science Framework* and *Computer Science Teachers Association K-12 Computer*

Science Standards (2017), are meant to reflect a future-focused vision for computer science education. The Indiana Academic Standards for Grades K-8 Computer Science:

- Build logically from kindergarten through grade eight;
- Integrate core student practices;
- Reflect the growing range of fields within computer science; and
- Focus on computer science as a collaborative endeavor.

The Indiana Academic Standards for Grades K-8 Computer Science include content knowledge and skills practiced and utilized in the real world. Engaging in the vertically-aligned Indiana Academic Standards for Grades K-8 Computer Science prepares students for success in high school computer science course sequences and complements skill requirements needed in other academic areas and career fields.

Core Practices

Seven core practices of computer science are integrated in the Indiana Academic Standards for Grades K-8 Computer Science. These practices describe behaviors and dispositions that computationally-literate students use in a data- and technology-rich society. Algorithmic problem solving and collaboration are highlighted in the standards and can be integrated as methods and tools across multiple disciplines. The core practices are:

1. Fostering an inclusive computing culture;
2. Collaborating around computing;
3. Recognizing and defining computational problems;
4. Developing and using abstractions;
5. Creating computational artifacts;
6. Testing and refining computational artifacts; and
7. Communicating about computing.

Core Concepts

As students move through grade levels, they will work with and experience the standards at those grade bands (K-2, 3-5, and 6-8). The standards are based on the five core concepts:

1. Data and Information (DI);
2. Computing Devices and Systems (CD);
3. Programs and Algorithms (PA);
4. Networking and the Internet (NI); and
5. Impact and Culture (IC);

Integrating the core practices and concepts in computer science learning experiences empowers students to think and communicate as a computer scientist, preparing them to solve real-world problems.

Acknowledgments

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participants in the public comment period, who dedicated many hours to the review and evaluation of these standards designed to prepare Indiana students for success after graduation.

References

Computer Science Teachers Association (2017). CSTA K-12 Computer Science Standards, Revised 2017. Retrieved from http://www.csteachers.org/standards.

K–12 CS Framework. (2016). Retrieved March 23, 2021, from http://www.k12cs.org

K-8 Computer Science

Standards identified as essential for mastery by the end of the grade band are indicated with gray shading and an "E." The learning outcome statement for each domain immediately precedes each set of standards.

Note: Empty boxes are placeholders to preserve alignment of vertically-articulated standards.

Data & Information		
Kindergarten - Grade 2	**Grades 3 - 5**	**Grades 6 - 8**
Learning Outcome: Students collect, store, visualize, and transform data to make inferences and predictions about the world.	**Learning Outcome:** Students select aspects and portions of data to be transformed, clustered, and categorized to provide views and insights about the data.	**Learning Outcome:** Students identify and implement multiple means of representing complex algorithms to communicate how applications store data as a representation understandable by people.
K-2.DI.1: Identify and collect data using digital tools (e.g., take pictures of all blue items, create a document with things that start with "a").	**3-5.DI.1:** Decompose problems and subproblems into parts as a means to solving complex problems. (E)	**6-8.DI.1:** Decompose (i.e., break down) problems into smaller, more manageable subsets by applying the algorithmic problem solving steps to make the possible solutions easier to follow, test, and debug. (E)
K-2.DI.2: Define stored information as data and when appropriate, copy, search, retrieve, modify, and delete it.	**3-5.DI.2:** Organize and present collected data visually to highlight relationships and support a claim.	**6-8.DI.2:** Collect data using computational tools (e.g., sensors, inputs like microphones) and transform the data to make it more useful and reliable.
K-2.DI.3: Model that data can be stored and manipulated using numbers or symbols to represent information.	**3-5.DI.3:** Demonstrate how variables can represent data and are used to store and modify information.	**6-8.DI.3:** Describe that data can be represented in multiple encoding schemes such as binary, RGB values (e.g., red, green, and blue intensity), and hexadecimal codes.
K-2.DI.4: Organize and present data in different visual formats such as charts, graphs, and symbols, and identify and describe patterns to make predictions. (E)	**3-5.DI.4:** Describe that data can be represented in different forms understandable by people, including words, symbols, and digital displays of color.	**6-8.DI.4:** Create visuals such as flowcharts, diagrams, and pseudocode to represent complex problems as algorithms. (E)
	3-5.DI.5: Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea. (E)	

Computing Devices & Systems		
Kindergarten - Grade 2	**Grades 3 - 5**	**Grades 6 - 8**
Learning Outcome: Students identify a computing system as being composed of hardware and software, troubleshooting common problems and generating solutions based on the needs of the user.	**Learning Outcome:** Students identify similarities between computing systems to troubleshoot common problems and choose appropriate combinations of hardware and software to accomplish desired tasks.	**Learning Outcome:** Students explain trade-offs, functionality, and accessibility of computer systems to improve the human-computer interaction.
K-2.CD.1: Use appropriate terminology in identifying and describing computer hardware. (E)	**3-5.CD.1:** Model how computer hardware and software work together to accomplish tasks.	**6-8.CD.1:** Design projects that combine hardware and software components to collect and exchange data. (E)
K-2.CD.2: Describe and troubleshoot basic hardware and software problems using appropriate terminology.	**3-5.CD.2:** Determine potential solutions to solve simple hardware and software problems using common troubleshooting strategies. (E)	**6-8.CD.2:** Systematically identify and fix problems (i.e., troubleshoot) with computing devices and their components (e.g., checklist, decision tree, flowchart).
K-2.CD.3: Select and operate appropriate software to perform a variety of tasks and recognize that users have different needs and preferences for the technology they use.	**3-5.CD.3:** Describe how internal and external parts of computing devices function to form a system.	**6-8.CD.3:** Recommend improvements to the design of computing devices based on analysis of how users interact with the devices. (E)
	3-5.CD.4: Describe what distinguishes humans from machines, focusing on human intelligence versus machine intelligence.	**6-8.CD.4:** Describe what distinguishes humans from machines, focusing on ways we can communicate, as well as ways in which computers use models of intelligent behavior (e.g., robot motion, speech and language understanding, computer vision).

Programs & Algorithms		
Kindergarten - Grade 2	**Grades 3 - 5**	**Grades 6 - 8**
Learning Outcome: Students model complex tasks using algorithmic problem solving and develop simple computing programs to represent them.	**Learning Outcome:** Students collaboratively engage in computer program development with consideration of documenting design choices and giving appropriate attributions.	**Learning Outcome:** Students collaboratively design meaningful solutions for others by defining a problem, carefully considering the diverse needs and wants of the community, and testing whether solutions fit the criteria defined in the problem.
K-2.PA.1: Breakdown and plan the order of the steps needed for a desired outcome to accomplish the goal. (E)	**3-5.PA.1:** Collaborate with peers to implement problem-solving steps to create a variety of programming solutions. (E)	
K-2.PA.2: Using age-appropriate vocabulary, explain steps taken and choices made to improve the design of a sequence.		
K-2.PA.3: Develop programs with sequences and simple loops to express ideas or address a problem. (E)	**3-5.PA.2:** Design programs that incorporate sequences, events, loops, and conditionals. (E)	**6-8.PA.1:** Design and iteratively develop programs that combine the following: sequencing, looping (including nested loops), conditionals (including compound conditionals), expressions, variables, functions, and parameters. (E)
K-2.PA.4: Identify and fix (debug) errors in sequences and simple loops.	**3-5.PA.3:** Test and debug (i.e., identify and fix errors) a program or algorithm to ensure it runs as intended.	**6-8.PA.2:** Systematically test and refine programs using a range of test cases. (E)
K-2.PA.5: Model daily processes by creating and following algorithms (i.e., sets of step-by-step instructions) to complete tasks. (E)		
K-2.PA.6: Give attribution when using the ideas and creations of others while developing programs.	**3-5.PA.4:** Observe intellectual property rights and give appropriate attribution when creating or remixing programs. (E)	**6-8.PA.3:** Incorporate existing code, media, and libraries into original programs and give attribution.
	3-5.PA.5: Describe choices made during program development using code comments, presentations, and demonstrations. (E)	**6-8.PA.4:** Document programs in order to make them easier to follow, test, and debug.

Networking & the Internet		
Kindergarten - Grade 2	**Grades 3 - 5**	**Grades 6 - 8**
Learning Outcome: Students explain that information shared over connected computer networks must be protected from unauthorized access.	**Learning Outcome:** Students describe how personal information is protected as information is transmitted over computer networks.	**Learning Outcome:** Students explain how information is sent and received securely across different networks and the internet.
K-2.NI.1: Explain what passwords are, why they are used, and why it is important to develop strong passwords to protect devices and information. (E)	**3-5.NI.1:** Discuss real-world cybersecurity problems and how personal information can be protected. (E)	**6-8.NI.1:** Explain how physical and cybersecurity measures protect electronic information. (E)
	3-5.NI.2: Model how information is broken down into smaller pieces, transmitted as packets through multiple devices over networks and the internet, and reassembled at the destination.	**6-8.NI.2:** Model the role of protocols in transmitting data across networks and the internet. (E)
		6-8.NI.3: Apply multiple methods of encryption to model the secure transmission of information.

Impact & Culture		
Kindergarten - Grade 2	**Grades 3 - 5**	**Grades 6 - 8**
Learning Outcome: Students explain how computing affects the way people live, work, and communicate.	**Learning Outcome:** Students describe how local and global collaboration is impacted by computing technology.	**Learning Outcome:** Students explain that society is faced with trade-offs due to the increasing globalization and automation that computing brings, as well as describe these trade-offs using multiple viewpoints from a diverse audience.
		6-8.IC.1: Exhibit legal and ethical behaviors when using technology and information and discuss the consequences of misuse. (E)
K-2.IC.1: Compare and contrast the effects of technology on communities and social interactions.	**3-5.IC.1:** Describe the positive and negative impacts of technology on one's personal life, society, and our culture. (E)	**6-8.IC.2:** Discuss issues of bias and accessibility in the design of existing technologies.
K-2.IC.2: Identify expected behaviors for working responsibly with others online. (E)	**3-5.IC.2:** Seek diverse perspectives for the purpose of improving computational artifacts.	**6-8.IC.3:** Collaborate with many contributors through strategies such as crowdsourcing or surveys when creating a computational artifact.
K-2.IC.3: Describe how to keep login information private and log off of devices appropriately.		**6-8.IC.4:** Describe tradeoffs between allowing information to be public and keeping information private and secure.
	3-5.IC.3: Critique computing technologies that have changed the world. Analyze how those technologies influence and/or are influenced by cultural practices and societal biases.	**6-8.IC.5:** Discuss how unequal distribution and participation in technology and computer science disadvantages marginalized populations.